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AUTHOR Grosset, Jane M.; Hawk, Thomas R.
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ABSTRACT

A socioeconomic status (SES) variable was developed and tested as a way to help identify high risk college students at the Community College of Philadelphia. Each city zip code was placed into either the lower, middle, or upper category, and students were assigned a SES measure based on their resident zip code. Using city-wide census data, the following five categories of economic and social indicators were available for all the 49 zip codes: population, income, poverty, educational attainment, and employment in the civilian labor force. Seven out of 13 variables were retained and factor analyzed: mean per-capita income, median household income, percentage of persons below the poverty level, percentage of high school and college graduates, percentage of individuals on unemployment, and percentage of individuals on work disability. Significant differences were found across SES groups for the following high-risk student indicators: reading placement test scores, grade point average (GPA), and course withdrawals. The SES variable was also applied in a holistic assessment for four outcome groups: high GPA dropouts, low GPA dropouts, students who were still enrolled, and completors. Numerous tables and a map are provided. (SW)

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CONSTRUCTION AND APPLICATION OF A SOCIO-ECONOMIC STATUS VARIABLE

Jane M. Grosset
Thomas R. Hawk

Community College of Philadelphia

June 23, 1986

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Ann K. Dickey, Chair
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Introduction

In an effort to maintain access and yet raise the percentage of students experiencing successful outcomes, increased effort at identifying "high risk" entering students is being expended by two-year colleges. Once identified, "high risk" students can be urged or mandated to choose courses at an appropriate level and provided appropriate support services. Over ninety percent of public two-year colleges now test entering students (Woods, 1985). However, a reliance on placement and admissions tests scores is not adequate to identify an entering student's needs for special support. Accurate counseling and program placement require a holistic assessment which considers, in addition to test results, data on students' prior education experiences and achievements, their educational aspirations, and socio-economic background.

Tinto (1975), in reviewing the existing research on the factors associated with college drop-out, suggested that retention depends on both a student's academic and social integration into a college environment. Reliance on test results alone in placing students in courses and support services results in a failure to consider the other dimensions of a student's background which may impact upon the student's retention and academic success. While no one variable has emerged as consistently reliable, research to date has generally supported the notion that students from socio-economically and

educationally disadvantaged backgrounds have more difficulty adapting to the expectations of higher education. This, in turn, results in a higher probability of poor academic performance and dropping out before completing educational goals. (See for example, Astin et al., 1972; Astin & Panos, 1969; Donovan, 1984; Gosman et al., 1983; Pantages & Creedon, 1978; Wilson, 1980.) Because of the general concurrence in these studies that socio-economic status (SES) was related to college performance, this study was initiated to see if a meaningful SES variable could be developed within the context of existing institutional data. This paper is a description of an approach to construct and apply a viable measure of a student's socio-economic background at a two-year public college in a large East-Coast city.

The challenge for a public open-door college is to gather usable SES data within the prevailing admissions and registration procedures. Data collection is problematic for several reasons. Many students defer application until shortly before the semester begins, making compilation of complete student profiles impossible. Enrollment during a last-moment, walk-in registration session is common. Timely access by counselors and advisors to the data which are collected at those registrations is often difficult. Furthermore, a large percentage of two-year students are independent and are frequently reluctant to provide information regarding parents' educational and occupational backgrounds. Family income is an unreliable measure of the student's socio-economic status, since this is typically low for

independent students irrespective of their family situation in their formative years. For these reasons, none of the variables typically used to compile SES information could be reliably collected in a timely fashion.

The challenge was to find a proxy variable for SES that was readily available. Resident zip code appeared to hold the most promise. The population density of the City served by the College has resulted in a large number of zip codes (49) within the College service area. Ninety-eight percent of the student body live within the City. These facts, coupled with the characteristic of the City to have relatively homogeneous neighborhoods, led to the formation of the hypothesis that zip codes could be used to help describe the students' SES backgrounds.

Research by Shevky and Bell (1955) supported the idea that zip codes could serve as a proxy for SES. They deduced there were three major dimensions of urban differentiation: social rank (economic status); urbanization (family status); and segregation (ethnic status). In their studies, Shevky and Bell used a factorial ecology approach which was characterized by the following: (1) interest in differentiation of residential areas within a metropolitan community; (2) extensive use of official census data as a primary source of variables; and (3) routine application of factor analysis procedures to explore census data (Jackson & Borgatta, 1981).

Description of the Present Study

This study was a multi-phase research project characterized by two fairly discrete steps - development and application.

In the development phase, factor analysis was used to build a suitable factor analysis model using City-wide census data. Factor score coefficients were used to compute two SES indices from which one trichotomized SES variable was constructed. Each City zip code was placed into either the lower, middle or upper category and students were assigned an SES measure based on their resident zip code.

In order to determine the fit between the proxy SES variable and the student body, one way analysis of variance, contingency tables and chi-square tests were used initially in the application section of the study.

SES was then combined with additional student information in order to determine if an effective predictor model for high risk students could be identified. A step-wise discriminant analysis was used in order to determine if the SES variable made a unique contribution to the holistic student assessment.

Methodology Related to Development of SES Variable

In this study, a quasi-factorial ecological approach was used to explore the possibility of using economic and social indicators available from the 1980 Census of Population and Housing to construct an SES index. If an appropriate factor analysis model could be identified, factor score equations would be used to construct an SES index for each of the 49 zip codes.

In turn, students would be assigned an SES measure based on their residential zip code.

Five categories of economic and social indicators, each with several associated measures, were available for all of the 49 zip codes. The indicators and measures appear in Table 1.

Table 1

Economic and Social Indicators
1980 Census of Population and Housing

Category	Measure
Population	Number of persons Number of families
Income	Per-capita income (mean) Family income (median) Household income (median)
Poverty	Persons below the poverty level (%) Families below the poverty level (%)
Education	High-school graduates (%) College graduates (%)
Civilian Labor Force	Unemployment level (%) Work disability level (%) Service industry (%) Retail-wholesale industry (%) Manufacturing (%)

With the exception of population, the measures associated with each of the categories fit conceptually within the SES construct. The original population measures were manipulated to compute a family-size variable for each zip code, which was used in the analysis instead of total persons and families.

Six of the 13 variables were eventually dropped from the analysis. Correlations of family income with per-capita income

(r = 0.93) and families below the poverty level with persons below the poverty level (r = 0.98) were extremely high, indicating that the two sets of variables contained trivially redundant content (Jackson & Borgatta, 1981). As a consequence, two separate factor analyses were undertaken, each including one of the two sets of income and poverty variables. Since both sets of variables resulted in approximately the same results, per-capita income and persons below the poverty level were kept in ensuing analyses while family income and families below the poverty level were dropped out. Family size and the three industry-related variables dropped out of the model because of low sampling-adequacy measures and small communalities.

The remaining seven items, mean per-capita income, median household income, percentage of persons below the poverty level, percentage of high school graduates and college graduates, percentage of individuals on unemployment and percentage of individuals on work disability, were factor analyzed using the FACTOR subprogram in SPSS-X. An iterative procedure (Maximum Likelihood) was used to extract the initial values, applying an eigenvalue criterion of 1.00 as the analysis termination point. The initial factor matrix was orthogonally rotated to its final solution using the varimax criterion.

Results Related to Construction of SES Variable

A two-factor solution is optimal based on the marginal eigenvalues criterion. The orthogonal solutions are presented in Table 2.

Table 2

Two Factor Solution: Loadings

Variable	Factor 1	Factor 2
% of persons below poverty	0.97756	-0.13891
Median household income	-0.86145	0.34837
% of unemployment	0.81309	-0.46203
% of disability	0.72568	-0.61875
% of college graduates	-0.09483	0.79996
% of high school graduates	-0.51465	0.79284
Mean per-capita income	-0.46090	0.72750

The four variables defining Factor 1, unemployment, disability, household income and poverty, relate to the level of economic deprivation in the zip code area.

Factor 2, which includes per-capita income, high school graduation and college graduation, can be thought of as providing a measure of educational attainments of zip code residents.

Indices representing the two dimensions derived from the factor analysis were constructed using only characteristic items for the factor rather than all items, irrespective of the size of their factor loadings. The Factor 1 score equation produced a scale ranging from -1.64 to 2.55. The scale for Factor 2 had a range between -1.44 and 3.15.

In most research applications, SES is measured on a nominal scale, generally including lower, middle and upper categories, therefore prior to assigning students an SES measure and integrating this information into the institutional data base, the following strategy was used to transform the two original continuous indices, economic deprivation and educational

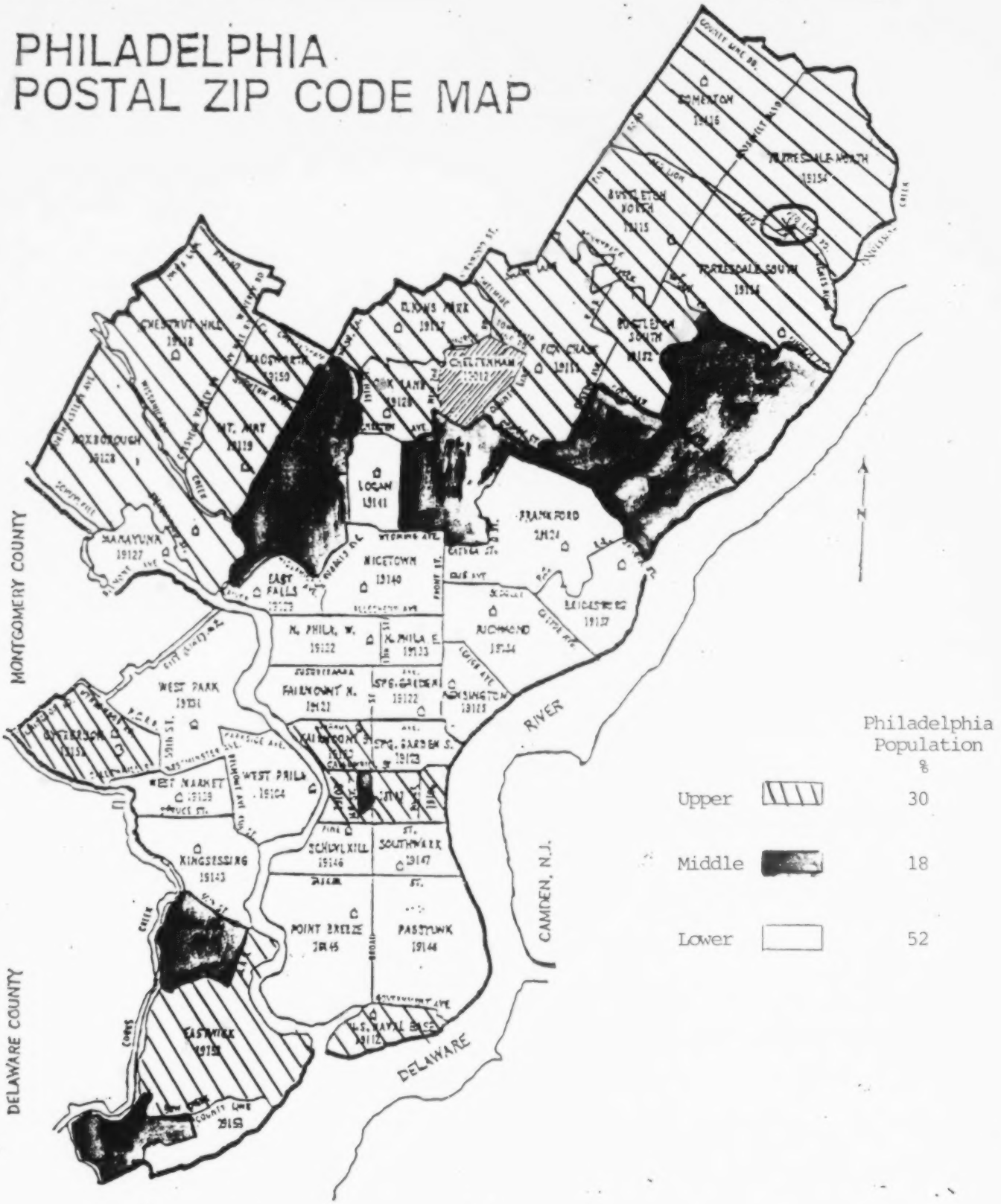
attainment, into one nominal level variable. Each City zip code was dichotomized into either high (1) or low (0) SES categories based on their associated index scores. This approach produced a combination of 1's and 0's for each zip code, which were then collapsed into one trichotomized variable using the following criteria:

Factor 1	Factor 2	SES Level
1	1	high
0	1	middle
1	0	middle
0	0	low

Most (81.6%) of the 49 City zip codes fit into consistent categorical patterns across indices. Only nine zip codes exhibited a mixed combination of high and low categories on the economic deprivation and educational attainment dimensions. An average category, middle, was used to define SES in these mixed neighborhoods. The SES City-wide breakdown, which appears in Figure 1, was shared with the City Planning Commission staff and College staff who were knowledgeable about City neighborhoods. Their assessment of the nature of Philadelphia neighborhoods paralleled that which was implied by the proxy variable. Neighborhoods which they regarded as homogeneous, in terms of SES, fell into the two extreme categories, lower or upper. Heterogeneous neighborhoods fell into the middle category.

FIGURE 1

PHILADELPHIA
POSTAL ZIP CODE MAP



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Methodology Related to the Initial Application of the SES Variable

The circumstances which resulted in the need for the SES variable made it impossible to directly validate the fit between the SES proxy variable and actual students' social and economic backgrounds. Major effort was therefore focused on observing how well the measure was related to student behavior while at the College.

Since the motivating force for the development of the new variable was to provide a unique dimension to a multi-attribute assessment of students in order to identify those least likely to succeed at the College, relationships between the SES variable and several high-risk student indicators were explored.

The following variables were included in this phase of the analysis since previous institutional research by the authors indicated that they were related to student success at the College:

1. Reading Placement Test Scores - Entering students are required to take the comprehension portion of the Descriptive Test of Language Skills (DTLS). Scores range from 0 to 45 and are used to place students in courses that are deemed appropriate for their ability.
2. Grade Point Average - Grade point averages based on first semester course work.
3. Course Withdrawals - The number of courses in which a student received a letter grade of 'W'.

Students enrolling for the first time in each Fall semester between 1979 and 1984 were assigned to one of the three SES categories based on their zip code residence.

Table 3 contains College SES figures for all students entering between Fall 1979 and Fall 1984. Compared to the City-wide distribution of SES, it appears that the College has served a much larger segment of the City population from lower SES backgrounds. Recently, this percentage has declined slightly, while enrollments among students from upper SES areas have increased. The percentage of students from the middle SES category is representative of City-wide figures and has held constant over the semesters.

It should be noted that these figures represent only students attending classes at the Center City location. If figures are included for the College's Regional Center and satellite locations, the student data becomes more reflective of the City-wide distribution.

Results Related to Initial Application of the SES Variable

One way analysis of variance was used to determine if significant differences existed across SES groups with regard to the high-risk measures.

As can be seen in Tables 4, 5 and 6, all of the analyses of variance yielded F statistics that were significant at $p < .001$. The Scheffe test for a posteriori comparisons indicated that both middle and upper SES subgroups scored higher reading scores than the lower SES subgroup. The reading ability of students from

Table 3

Percentage of Entering Students by Socio-Economic Status Categories - Fall, 1979 through Fall, 1984

Semester	Lower Socio-Economic Status Group	Middle Socio-Economic Status Group	Upper Socio-Economic Status Group
	%	%	%
Fall 1979	62.3	16.6	21.1
Fall 1980	60.9	15.6	23.5
Fall 1981	63.6	15.0	21.4
Fall 1982	63.9	16.5	19.5
Fall 1983	60.3	15.5	24.2
Fall 1984	59.8	16.6	23.6

Table 4

Mean Reading Scores by SES Groups
Entering Students in Fall Semesters
Fall 1979 Through Fall 1984

	Lower Socio-Economic Status Group			Middle Socio-Economic Status Group			Upper Socio-Economic Status Group			
Semester	Mean	(SD)	n	Mean	(SD)	n	Mean	(SD)	n	F
Fall 1979	27.6	(8.22)	931	30.4	(8.07)	268	30.3	(7.46)	247	19.52***
Fall 1980	27.2	(8.25)	914	29.9	(8.24)	233	30.2	(7.91)	302	20.77***
Fall 1981	27.2	(8.04)	787	29.5	(8.23)	219	30.7	(8.08)	245	20.46***
Fall 1982	26.4	(8.90)	855	29.7	(8.40)	247	30.3	(8.09)	279	29.01***
Fall 1983	25.6	(9.54)	1118	29.3	(9.31)	308	29.6	(7.88)	393	38.78***
Fall 1984	27.2	(8.53)	1216	29.8	(8.51)	2364	30.2	(8.20)	2808	192.34***

*** $p < .001$

Table 5

Mean Grade Point Average by SES Groups
Entering Students in Fall Semesters
Fall 1979 Through Fall 1984

	Lower Socio-Economic Status Group			Middle Socio-Economic Status Group			Upper Socio-Economic Status Group			
Semester	Mean	(SD)	n	Mean	(SD)	n	Mean	(SD)	n	F
Fall 1979	2.0	(1.13)	1692	2.2	(1.14)	448	2.3	(1.19)	568	14.51***
Fall 1980	2.0	(1.13)	1570	2.2	(1.10)	401	2.2	(1.17)	605	11.89***
Fall 1981	2.1	(1.11)	1559	2.2	(1.10)	368	2.3	(1.17)	524	8.19***
Fall 1982	2.1	(1.13)	1615	2.2	(1.15)	418	2.4	(1.12)	493	11.69***
Fall 1983	2.0	(1.18)	1781	2.1	(1.16)	459	2.3	(1.23)	714	15.75***
Fall 1984	2.0	(1.20)	15485	2.2	(1.20)	3966	2.3	(1.24)	5664	118.82***

*** $p < .001$

Table 6

Mean Course Withdrawals by SES Groups
Entering Students in Fall Semesters
Fall 1979 Through Fall 1984

	Lower Socio-Economic Status Group			Middle Socio-Economic Status Group			Upper Socio-Economic Status Group			
Semester	Mean	(SD)	n	Mean	(SD)	n	Mean	(SD)	n	F
Fall 1979	2.2	(2.63)	1692	1.8	(2.28)	448	1.6	(2.23)	568	12.95***
Fall 1980	2.1	(2.50)	1570	1.7	(2.12)	401	1.6	(2.09)	605	13.06***
Fall 1981	1.9	(2.28)	1559	1.7	(2.08)	368	1.4	(2.03)	524	10.48***
Fall 1982	1.6	(2.02)	1615	1.4	(1.83)	418	1.3	(1.74)	493	7.03***
Fall 1983	1.2	(1.60)	1781	1.1	(1.50)	459	0.9	(1.38)	714	10.54***
Fall 1984[1]	0.7	(1.10)	1736	0.6	(1.02)	483	0.5	(0.92)	684	7.93***
Overall	1.5	(2.07)	15485	1.2	(1.85)	3966	1.1	(1.73)	5664	103.97***

*** $p < .001$

[1] The drop in Fall 1984 course withdrawals reflects a change in the Academic Standards Policy related to poor progress that was initiated in that semester.

middle and upper SES backgrounds did not differ. These results were consistent across the six semesters and when students were combined over semesters.

The Scheffe test also indicated that lower SES students earned lower grade point averages than the upper SES group across all six semesters. In half of the semesters, Fall 1979, 1980 and 1983, they also earned lower grade point averages than the middle SES group. When students were combined, the students from lower SES backgrounds differed from both of the other two SES groups.

With regard to course withdrawals, students from upper SES backgrounds consistently withdrew from fewer courses than students from lower SES backgrounds. Additionally, the lower SES group dropped significantly more courses than the middle SES group in the Fall 1979 and Fall 1980 semesters. When combined, students from lower SES backgrounds withdrew from more courses than students from either of the other two categories.

These results were generally consistent with the research findings of others (Astin et al., 1972; Donovan, 1984; Gosman et al., 1983; Wilson, 1980).

Methodology Related to Application of SES Variable

Having established that a reasonably useful SES proxy measure could be constructed using resident zip code, its usefulness in terms of a holistic student assessment needed to be explored. The goal of the assessment was to identify students, at the time they initially enrolled at the College, who were most likely to leave the College prior to achieving their educational

objectives. It was hoped that timely intervention with an appropriate combination of recommended or mandated course selections and support services would improve the students' academics and overall success at the College.

Success was measured in terms of long-range student outcomes that went beyond consideration of only graduation rates. Since Entering Student Surveys have indicated that approximately half of recent entering classes did not plan to earn a degree at the College, success was defined with student degree intentions and educational objectives in mind. Based on this strategy, all students entering the College in Fall 1979, Fall 1980 and Fall 1981 were placed in one of the following outcome categories based on their status as of Spring 1985.

1) **Completors** - This category included students who were either awarded a degree or did not receive a degree but earned 60 or more credits and maintained a grade point average of at least 2.0. This was not considered to be a high-risk group since they were either program completors or earned a sufficient number of credits and maintained the necessary academic standards to qualify for a degree. Institutional studies have determined that a large number of students who meet the latter conditions eventually transfer to four-year baccalaureate schools.

2) **High GPA, Drop-Outs** - This group included students who left prior to earning a degree with fewer than 60 credits and an earned grade point average of at least

2.0. This category was quite heterogeneous, including students with a variety of non-degree educational objectives such as personal enrichment, desire to earn transfer credits and improvement of specific job-related skills. Also included in this group were degree-oriented students who experienced some type of personal conflicts that interferred with their degree plans. Since this latter group was hypothesized to be a small proportion of the total group, that in spite of their personal problems did well academically, this category of students was considered to be succesful.

3) **Low GPA, Drop-Outs** - Students who left prior to earning a degree with fewer than 60 credits and an earned grade point average less than 2.0 were included in this group. These students either lacked the necessary academic skills needed for their studies when entering the College or encountered personal problems which manifested themselves in poor grades. This group was considered to be high-risk and because of the nature of the proposed support systems, the group most likely to benefit from early identification.

4) **Persisters** - These were students who were still enrolled as of Spring 1985, in some cases six years after their initial enrollment at the College. Students in this category maintained, for the most part, at least a 2.0 grade point average. The duration of their attendance was most likely a function of part-time attendance and

stopping-out behavior, rather than academic difficulties, per se. Therefore, this group was not considered high-risk.

These four groups, while maintaining heterogeneous characteristics within each category, were sufficiently discrete from one another to provide meaningful student placements based on the nature of the support system that was being considered. While a meaningful discrimination among all four groups that would lead to an understanding of the student types was a general research objective, identification of the low GPA, drop-out group was the critical research issue.

A fairly large time span, ranging from four to six years, was considered prior to assigning entering students from Fall 1979, 1980 and 1981 into one of the four outcomes categories. Given enrollment factors such as part-time attendance and stopping-out behavior, it was anticipated that inclusion of students from more recent semesters would not allow for sufficient time lapse, thereby leading to inaccurate placement into groups.

The bivariate relationship between the SES categories and the outcome categories was initially explored. If a relationship was observed in these bivariate analyses, the SES variable would be included in a multivariate situation to determine its unique contribution to the predictive model. The other predictors included in this phase of the analysis were:

- Age at initial enrollment
- Reading ability scores (DTLS)
- Employment status at initial enrollment
- Student goals at initial enrollment
- Degree orientation
- Sex
- Race
- Prior post-secondary education
- Commitment to educational goals and objectives

Results Related to Application of SES Variable in the Holistic Assessment

Contingency tables and chi-square analyses were calculated to determine if the SES variable was related to the four student outcome groups. Results of these analyses appear in Table 7. They indicate that for entering classes in each of the three semesters, students with a lower SES background were less likely to graduate than the other two student groups, although in Fall 1981 the difference between lower and upper SES was minimal. Lower SES students were also the most likely of the three SES groups to appear in the low GPA, drop-out groups, and in both Fall 1979 and Fall 1980 they were more likely to drop out with a low GPA than with a GPA of 2.0 or better.

Students from upper SES backgrounds were the least likely persisters and in both Fall 1979 and Fall 1981 the most likely high GPA, drop-outs. Differences betweeen middle and upper SES high GPA, drop-outs in Fall 1980 was minimal.

Students from middle SES backgrounds were well-represented among the completors; in fact, in both Fall 1979 and Fall 1981 of the three SES groups, middle SES students were the most likely completors. They were also the most likely persisters in Fall

1980 and Fall 1981. In terms of drop-out patterns, they most closely resembled students from upper SES backgrounds.

Many of the patterns evidenced in Table 7 can best be understood within the context of the economics of attending higher education. The lower percentage of students with low SES backgrounds among the completor group is probably a function of the need for these students, in many cases, to locate a job and generate an income as soon as possible, foregoing degree completion in the process. For this group, even slight shifts in financial support can change college attendance patterns. The immediacy attached to locating a job coupled with less disposable income available for education also contribute to a lower rate of transfer to four-year schools associated with these students.

The under-representation of upper SES students in the completor group is probably due to economic considerations as well. Since upper SES students have more disposable income available to them for educational purposes, the economic considerations leading them to forego degree completion, however, are based on tuition savings rather than an immediacy to work. These students tend to view community college enrollment as a step in the transfer process and choose to earn a portion of their credits toward a baccalaureate degree at the lower-priced community college, often transferring prior to earning an associate degree.

The greater financial freedom of upper SES students clearly provides them with more options to community college enrollment, and could account for the uneven distribution of the three SES

Table 7

Analysis of Socio-Economic Status by Study Outcome
Entering Student 1979, 1980, 1981

Semester	Socio-Economic Status Group	OUTCOME: Completors N	Completors %	Hi-GPA Drop-Out N	Hi-GPA Drop-Out %	Low-GPA Drop-Out N	Low-GPA Drop-Out %	Persistor N	Persistor %	X^2
Fall '79										
	Lower	275	16.3	665	39.3	695	41.1	57	3.4	26.32***
	Middle	93	20.8	180	40.2	162	36.2	13	2.9	
	Upper	100	17.6	277	48.8	176	31.0	15	2.6	
Fall '80										
	Lower	205	13.1	602	38.3	675	43.0	88	5.6	23.91***
	Middle	64	16.0	173	43.1	139	34.7	25	6.2	
	Upper	109	18.0	259	42.8	213	35.2	24	4.0	
Fall '81										
	Lower	224	14.4	617	39.6	603	38.7	115	7.4	23.36***
	Middle	65	17.7	154	41.8	116	31.5	33	9.0	
	Upper	77	14.7	256	48.9	164	31.3	27	5.2	

*** $p < .001$

categories among the persister group. Upper SES students, presumably with the most options, are the least likely persisters, while middle and lower income students with fewer or no other financial alternatives are most likely to persist at community colleges.

In addition to financial concerns, students from lower SES backgrounds are more likely to experience other types of personal problems which could interfere with their studies and possibly result in lower grades and/or dropping out. Middle income students who would not be as affected by these personal factors are therefore more likely to perform better academically and persist. This would also account for the larger percentage of middle SES students as persisters and the good showing of middle income students in the completor group.

Many students from lower SES backgrounds are underprepared for the academic demands of higher education because of the uneven quality of education that exists within many inner-city high schools. These academic deficiencies, coupled with economic and personal pressures, contribute to their poor academic showing and eventual dropping-out behavior as evidenced by their numbers in the low GPA, drop-out category.

These findings are consistent with those associated with the analysis of variance reported earlier. In order to determine if the contribution made by the SES variable in identification of outcome groups would hold up in a multivariate situation, a four-group discriminant analysis was undertaken. For the discriminant analysis, students from all three semesters were combined.

A step-wise discriminant approach was used to determine if SES, when combined with 18 other variables, would be helpful in differentiating among the four outcome groups. If the SES variable was entered into the analysis, it would demonstrate its utility as a unique dimension in the holistic assessment of students. If, on the other hand, it failed to meet the minimum criteria for entry, it would be assumed that it provided essentially redundant information that was already available from the data base. For this reason, the interaction of race and SES were of particular interest.

Table 8 contains the means and standard deviations for each of the variables considered for inclusion in the discriminant functions.

Based on a univariate F test, the SES variable sample means were significantly different across groups. As evidenced in Table 8, students with lower SES backgrounds were more likely to fall into the low GPA, drop-out group, while the other three outcomes groups had SES values that were larger and nearly identical. This finding parallels those based on contingency tables and chi-square analysis reported in Table 7.

In the stepwise procedure, Wilks' lambda was used as the criterion for variable selection, with a significance of .1 (F to enter) used to qualify variables for entry. Of the 19 variables that were possible predictors, 18 met the minimum criteria for entry. The SES variable was entered in the process at step 17.

All three of the possible discriminant functions in this analysis proved to be statistically significant. The summary

Table 8

Means and Standard Deviation for Discriminant Variables for Students in Four Outcome Categories

Variable	Low-GPA Drop-Out	High-GPA Drop-Out	Graduates	Persisters
Socio-Economic Status (1 = Lower, 2 = Middle, 3 = Upper)	**1.52*** (0.788)**	**1.69 (0.861)**	**1.68 (0.851)**	**1.65 (0.811)**
Age	22.9*** (7.47)	25.4 (8.85)	24.5 (8.79)	26.8 (10.03)
Reading Score	27.6*** (6.19)	29.2 (5.55)	29.3 (6.53)	28.1 (5.38)
Number of Dependents	0.6** (1.16)	0.6 (1.13)	0.7 (1.23)	0.8 (1.27)
Employment Status (0 = unemployed, 1 = employed)	0.41*** (0.49)	0.57 (0.49)	0.43 (0.49)	0.64 (.048)
Enrolled to Improve Job Skills (0 = no, 1 = yes)	0.14*** (0.35)	0.16 (0.37)	0.09 (0.29)	0.18 (0.38)
Enrolled to Prepare for a Job (0 = no, 1 = yes)	0.42*** (0.49)	0.34 (0.47)	0.50 (0.50)	0.39 (0.49)
Enrolled to Earn Transfer Credit (0 = no, 1 = yes)	0.33*** (0.47)	0.38 (0.48)	0.34 (0.47)	0.29 (0.46)
Enrolled for Personal Interest (0 = no, 1 = yes)	0.09*** (0.28)	0.10 (0.29)	0.05 (0.22)	0.07 (0.26)
Plans to Take Just a Few Courses (0 = no, 1 = yes)	0.40*** (0.49)	0.46 (0.50)	0.25 (0.43)	0.32 (0.47)
Plans to Earn a Degree (0 = no, 1 = yes)	0.46*** (0.50)	0.41 (0.49)	0.64 (0.48)	0.54 (0.50)
Sex (0 = male, 1 = female)	0.60*** (0.49)	0.61 (0.49)	0.65 (0.48)	0.69 (0.46)

Variable	Low-GPA Drop-Out	High-GPA Drop-Out	Graduates	Persisters
Black (0 = not black, 1 = black)	0.68*** (0.46)	0.47 (0.50)	0.49 (0.50)	0.51 (0.50)
White (0 - not white, 1 = white)	0.24*** (0.43)	0.44 (0.50)	0.40 (0.49)	0.41 (0.49)
Asian (0 = not Asian, 1 = Asian)	0.01*** (0.09)	0.02 (0.14)	0.04 (0.21)	0.02 (0.14)
Hispanic (0 = not Hispanic, 1 = Hispanic)	0.04 (0.19)	0.04 (0.19)	0.03 (0.17)	0.03 (0.17)
Prior Higher Education Experience (0 = no, 1 = yes)	0.02*** (0.15)	0.06 (0.24)	0.18 (0.39)	0.09 (0.28)
Definitiveness of Plans (0 = not at all definite, 1 = somewhat definite, 2 = very definite)	0.72 * (0.45)	0.70 (0.46)	0.75 (0.43)	0.70 (0.46)

*** $p < .001$
** $p < .01$
* $p < .05$

Significance level of the sample mean differences among students in four outcome groups using a one-way analysis of variance F test.

statistics for the three functions are shown in Table 9. However, the first and second function account for a total of 91.7% of the total discriminating capabilities of the three functions. Using a chi-square test for the significance of Wilks' lambda, each function's means were found to have statistically significant differences.

To begin to understand the contribution which each function is making to discriminating among outcome groups, and the importance of the SES variables to the identification of the groups, the values of the group centroids for each function are shown in Table 10.

The first function has group means which are most separated for the high-risk group and completors. The persister and high GPA, drop-out means were not greatly different from each other for this function and were in the middle of the other two groups. Function two has group means which are most different for completors and high GPA, drop-outs, while the last function has a group mean for persisters which is different than the means for the other groups, all of which are fairly similar. All four of the outcome groups exhibit a fairly large mean difference from the other groups on at least one of the functions.

To understand the relationship between the SES variable and the functions and thereby the importance of the SES value in the assessment process, both the structure and standardized discriminant coefficients were examined. They appear in Tables 11 and 12, respectively.

Table 9

Summary Statistics for the Results of Discriminant Analysis to Identify Differentiating Characteristics of the Student Outcome Groups

Function	Percent of Discrimination Attributable to Function	Cannonical Correlation	Wilks' Lambda	Chi-Squared	Significance
1	55.14	0.315	0.825	1152.8	$p < .001$
2	36.60	0.261	0.917	523.5	$p < .001$
3	8.26	0.127	0.984	98.6	$p < .001$

Table 10

Group Centroids for the Three Discriminant Functions for Student Outcome Groups

	Group Centroids		
Group	Function One	Function Two	Function Three
Low GPA, Drop-Out	-0.415	0.117	-0.012
High GPA, Drop-Out	0.138	-0.266	0.071
Graduate	0.467	0.497	0.051
Persister	0.292	-0.134	-0.429

The largest structure coefficient for SES (0.261) was associated with function one, which separated the high-risk and completor groups. Although correlations between race, prior educational experience, age and function one were all larger than the correlation between function one and SES, the SES coefficient is nonetheless noteworthy.

The SES structure coefficients for functions two and three were identical in size, although only half as large as function one. For function two, the correlation was negative, indicating an association with the high GPA, drop-out group, while in function three, the correlation was positive indicating an association with the three non-persister outcome groups, in particular the completors and high GPA, drop-outs.

The findings from the standardized discriminant coefficients, which appear in Table 12, are similar to the structure coefficient patterns. All signs are consistent with earlier findings. The SES discriminant coefficients are largest for functions one and three. When all 19 predictors are considered, SES contributes most to function one, its coefficient ranking 11th in size. SES has a ranking of 15th in the function three column and ranks last for function two.

The classification results for the discriminant analysis are shown in Table 13. Prior probabilities were used in the analysis. Based on thse probabilities, the likelihood of randomly placing students correctly into the high-risk group is 36.2%, correct placement into the completors category would occur 15.3% of the time, 40.8% of the time for high GPA, drop-outs and 7.5% of the time for persisters.

Table 11

Structure Coefficients for the Three Discriminant Functions Derived for the Student Outcome Groups

Variable	Function One	Function Two	Function Three
Black	-0.554 *	0.283	-0.264
Prior higher education experience	0.543 *	0.425	0.071
White	0.526 *	-0.347	0.194
Age	0.361 *	-0.303	-0.315
SES	0.261 *	-0.133	0.133
Asian	0.235 *	0.145	0.101
Employment status	0.291	-0.510 *	-0.336
Degree-oriented	0.224	0.505 *	-0.332
Enrolled to take a few courses	-0.165	-0.485 *	0.395
Enrolled to prepare for a job	0.010	0.438 *	-0.094
Enrolled to improve job skills	-0.040	-0.263 *	-0.150
Enrolled for personal interest	-0.079	-0.187 *	0.139
Definitiveness of plans	0.023	0.128 *	0.055
Reading test score	0.339	-0.123	0.463 *
Enrolled to earn transfer credit	0.061	-0.113	0.338 *
Dependents	0.054	0.065	-0.319 *
Sex	0.109	0.039	-0.279 *
Hispanic	-0.046	0.033	0.056 *

Table 12

Standardized Discriminant Coefficients for the Three Discriminant Functions Derived for the Study Outcome Groups

Variable	Function One	Function Two	Function Three
SES	**0.080**	**-0.001**	**0.086**
Age	0.369	-0.317	-0.178
Reading test score	0.215	-0.074	0.439
Dependents	0.020	0.080	-0.179
Employment status	0.173	-0.389	-0.423
Enrolled to improve job skills	-0.700	-0.107	0.606
Enrolled to prepare for a job	-0.011	0.237	0.839
Enrolled to earn transfer credit	0.087	-0.045	0.946
Enrolled for personal reasons	-0.076	-0.045	0.614
Enrolled to take a few courses	0.039	-0.016	0.372
Degree-oriented	0.269	0.472	-0.034
Sex	0.246	-0.042	-0.214
Black	-0.212	-0.059	-0.366
White	0.318	-0.281	-0.212
Asian	0.258	0.110	0.032
Hispanic	0.002	-0.106	-0.023
Definitiveness of plans	0.009	0.093	0.167
Prior higher education experience	0.519	0.425	0.051

Table 13 classification results indicate a fair amount of success in correctly identifying the high-risk group. Nearly fifty-five percent (54.6%) of the students were correctly placed into this group, an improvement of 19% over random placement. The high GPA, drop-out group was the most readily identified group. The predictive model was only modestly successful in identifying completors and unsuccessful in breaking out persisters. This is not surprising, since function three, which was most influential in separating persisters from the other three outcome groups, accounted for a very small proportion of the explained variance in the three function model.

Discussion

In the discriminant analysis, the SES variable emerged as statistically significant in the holistic assessment process, albeit with a contribution to overall variability explanation that was modest. It has been demonstrated, however, that the proxy variable does make a unique contribution to understanding student outcomes which cannot be attributed to other factors such as race or age.

Institutional effort to utilize the SES variables have been appropriately cautious, with the knowledge that the SES variable provides limited additional information about the student that should only be used in the context of a holistic assessment. Counselors and advisors will use the SES variables as a cue to explore fully with the student needs for additional support services during their first semesters of enrollment at the College.

Table 13

Classification Results for the Three Discriminant Functions for the Study Outcome Groups

	Percent Predicted in Group			
Actual Group	Completors	High GPA Drop-Outs	Low GPA Drop-Outs	Persistors
Completors	218 (17.1)	628 (49.2)	429 (33.6)	2 (0.2)
High GPA, Drop-Outs	195 (3.7)	3435 (65.4)	1616 (30.8)	4 (0.1)
Low GPA, Drop-Outs	71 (1.8)	1701 (43.6)	2128 (54.6)	1 (0.0)
Persisters	44 (7.4)	348 (58.4)	201 (33.7)	3 (0.5)

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